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ABSTRACT

So that postsecondary institutions can meet the training needs of business and industry, this guide has been developed to help colleges increase and improve their active participation in assisting businesses and industries to use advanced technology. It provides suggestions for keeping faculty up to date, acquiring the latest equipment, and providing programs for training new workers as well as upgrading present workers. The guide also suggests means of using new curricula and delivery systems and modifying existing programs. The guide presents strategies and recommendations for rapid and appropriate responses to new technological development, based on data gathered in the Technology Adaptation Project. The strategies and recommendations for successful practices are divided into four areas: program planning; financing and equipping; staff development and recruitment; and curricula development and delivery systems. A summary of the Technology Adaptation Project is included in the guide. (KC)

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Research and Development Series No. 231

Preparing for High Technology:
A Guide For Community Colleges

James P. Long
Catharine P. Warmbrod

The National Center for Research in Vocational Education
The Ohio State University
1960 Kenny Road
Columbus, Ohio 43210

1982

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FOREWORD

Community and technical colleges play a very important role in training workers for high-technology occupations and in upgrading workers as technological change occurs. The continual change and the rapid advance of high technology provide a strong challenge to postsecondary institutions to keep up to date and to make the adaptations this role requires.

For these reasons National Postsecondary Alliance members have a strong interest in serving industry's training needs for high technology. This guide has been prepared to serve those interests and needs.

Appreciation is expressed to members of the Technology Adaptation Project for the information they compiled in their case studies of postsecondary institutions and industry engaged in high technology. It is from this information base of successful practices that the authors of this paper drew a great deal of information.

Robert E. Taylor
Executive Director
The National Center for Research
in Vocational Education

EXECUTIVE SUMMARY

The continual advance of high technology creates a challenge for postsecondary institutions to meet the training needs of business and industry. It requires keeping faculty up to date, acquiring the latest equipment, and providing programs for training new workers as well as upgrading present workers. It also means utilizing new curricula and delivery systems and modifying existing programs.

As new technological developments are transferred to business and industrial use, the developments must be monitored closely by community and technical colleges as they train workers for these firms. Rapid and appropriate responses are needed to serve industries' high-technology training needs. This paper presents strategies and recommendations for such responses, based on data gathered in the Technology Adaptation Project. The strategies and recommendations for successful practices are divided into four areas: program planning, financing and equipping, staff development and recruitment, and curricula development and delivery systems.

This guide is intended to help colleges increase and improve their active participation in assisting businesses and industries to utilize advanced technology.

INTRODUCTION

Community and technical colleges face a continuing challenge to keep up with rapidly advancing technology. There are dramatic advances in such fields as computer applications, microelectronics, and automated machinery and processes. These technological developments in industry require important changes in technician education in the two-year college. Both colleges and industries are challenged to keep up to date with changing technology and to make the adaptations it requires. Some industries, such as steel and automobile manufacturers, have not kept pace with what technology has to offer. Such industries find themselves in a squeeze between foreign competition and rising costs of energy, labor, and materials.

Although some industries or companies within those industries are struggling, others are successfully using new technologies to increase their share of the market, improve productivity, and utilize human resources more effectively. The improvements they have achieved have often required substantial changes in work settings, equipment and processes, job performance requirements, and occupational demands. Since adopting or adapting new technologies is part of the competitive edge for any company, there are serious implications for the companies' utilization of human resources and equipment and for the educational institutions that prepare people to work in such companies. New technological developments affect labor demand, the kind of occupations, and job content and skill requirements within an industry.

If postsecondary vocational education is to play a role in aiding businesses and industries to maintain or regain their technological leadership and improve productivity, innovative approaches and strategies are needed. Even more important, postsecondary institutions will need to become actively involved in helping transfer technological innovations to industry. Vocational educators should be encouraged to move beyond their current reactive roles to a more aggressive stance in promoting the use of new technology in the business and industrial community.

Developing technician-level training programs for new technologies requires that postsecondary planners and administrators rethink their traditional strategies for initiating and updating high-technology programs. Technician training in advanced technologies (such as computer applications, robotics, and lasers) requires sophisticated and costly equipment, continually updated curricula, and instructors qualified on both the knowledge and experience levels in the latest technological developments and equipment. Schools face serious problems in finding or developing state-of-the-art curricula in new technology areas. Recruiting qualified instructors is equally difficult. Further complicating the situation is the fact that improvements in equipment and processes occur at a rapid pace, resulting in frequent obsolescence of equipment and skills. These, in turn, create new occupations and a demand for new skills.

Although postsecondary institutions risk loss by waiting until the training specifications for technicians in advanced technologies are well established before starting up a new program, such delays are costly to the community and to the nation. If postsecondary institutions do not respond early to the need for trained technicians, that responsibility will be taken over by the in-house training programs of those businesses and industries that can afford to develop and conduct them. Postsecon-

dary institutions will have lost an opportunity to serve business and industry. The postsecondary role in occupational education will have been lessened, and those companies that cannot afford in-house training programs will not have been served at all.

This paper examines how some postsecondary institutions have responded early and effectively to the challenges of meeting high-technology training needs. Problems and successes in creating and conducting new programs were analyzed, with special emphasis on planning, developing curricula, acquiring equipment, and securing qualified staff. Strategies and recommendations are also presented on ways for community and technical colleges to be effective agents for training the technicians needed in an age of high technology.

SUCCESSFUL PRACTICES AND RECOMMENDATIONS

The successful practices reviewed in this section are based upon the data gathered by the Technology Adaptation Project, described in Appendix A. The recommendations are based on ideas gleaned from practitioners, reviewers, and personal experiences. These strategies, implications, and recommendations are presented at the request of the institutional members of the National Post-secondary Alliance, listed in Appendix C. This guide is intended to help them and other colleges that wish to increase and improve their active participation in assisting businesses and industries in utilizing advanced technology. These guidelines are organized and presented according to four areas of function: program planning, financing and equipping, staff development and recruitment, and curricula and delivery systems.

Program Planning

1. A local or regional group of employers, such as an advanced technology council, can help create and finance new, advanced technical education projects. One good example of this is Milwaukee Area Technical College's Partners in Progress. Another is the Massachusetts High Technology Council. This latter organization conducts surveys to obtain current information on the projected employment needs of Council members.

   Recommendation: Contact your state department of economic development or its equivalent to learn if such a group or council exists. If not, take leadership in organizing one.

2. In planning for a new advanced technology, employers in the service area are regularly assessed to identify what new competencies they will need and if they would hire the graduates of a program teaching such competencies. All colleges visited conducted needs assessments of some type.

   Recommendation: Don't mail out hundreds of long, complicated questionnaires. Instead, convene a small group of six or eight employers to help you narrow the field of investigation. Based on their input, mail brief questionnaires to a target audience.

3. There must be a good knowledge base upon which to build a new technical competency. The Medical Electronics Technology program at Franklin Institute in Boston starts with students who have a strong engineering course background, and then proceeds to give them courses and experiences at Tufts-New England Medical Center.

   Recommendation: Brainstorm with the leaders at your college to discover a similar strong knowledge base existing in your service area. Perhaps underemployed four-year college graduates, or your own graduates, are candidates for a new high-technology program.

4. With distinctly new technological developments, there usually is not an existing group of experts from whom advice and help can be obtained to update faculty and develop new programs. If experts exist, they often have to be found outside the area or state. The sources of

help are often from corporate or university research and engineering departments. To establish (at selected technical colleges) the advanced technology resource centers that are part of South Carolina's Design for the Eighties program, state representatives traveled nationwide to gather information and identify experts to serve as advisors. The state representatives met with leading high-tech corporation representatives, researchers, and educators. This resulted in the establishment of five Resource Centers for the state: (a) Computer Application at York Technical College, (b) Electronics at Tri-County Technical College, (c) Robotics at Piedmont Technical College, (d) Future Office Occupations at Midlands Technical College, and (e) Advanced Machine Tool Technology at Greenville Technical College.

Recommendation: Multi-campus districts, consortia of colleges, statewide two-year college systems, or state departments of economic development could undertake similar endeavors. Put the issue on the agenda of your next meeting, or organize your own consortium if there is none.

5. Collaboration between a company or industry and a college may be initiated by either, and usually develops because of a mutual recognition of need. Companies involved in such collaborations play important roles on colleges' advisory committees.

   Recommendation: As a start, work closely with one highly visible company. Then publicize your cooperative venture in order to encourage other companies to initiate requests for mutual assistance.

6. Private companies often assist colleges in preparing for high technology by providing information as early as possible about future technological changes, job requirements, and training needs.

   Recommendation: Attend a conference at which industry representatives address college leaders concerning high technology, or organize and conduct such a conference yourself.

7. All the institutions reviewed were interested in forming or joining alliances with other postsecondary institutions for the purpose of sharing the costs of developing new programs and courses in high-technology areas. Such alliances can make the costs of a new high-tech program feasible through the sharing of materials, ideas, personnel, expertise, and physical resources. A good example of such an alliance is the National Postsecondary Alliance associated with the National Center for Research in Vocational Education. The National Postsecondary Alliance sponsored the production of the guidebook you are now reading. Another example is that of six colleges under the Utah State Board of Regents which cooperate to prepare specific educational packages for industry. A team composed of educators and persons from industry work under an instructional developer to prepare curriculum materials. These materials are used in the training and upgrading of personnel.

   Recommendation: Join an alliance or consortium, or start your own.

8. Decisions on whether or not to develop a proposed new program should be based on measures of: (a) the rate of substantive change in the particular technology; (b) the degree to which companies are adopting the technology; (c) the capacity for collaboration by the industry, community, and the college in developing the new program; and (d) the effect of the program on economic growth in the community. Cincinnati Technical College took a survey of area employers to assess the need for laser-optics technicians and to assess the willingness of local industries to support a training program in laser-optics technology by providing co-op training in their companies. The most difficult part of the program planning is selecting up-and-coming program areas for needs assessment surveys.

Recommendation: Read publications such as *The Futurist,* reports of the Trend Analysis Program of the American Council of Life Insurance, U.S. Department of Labor reports, *Technology Review,* and area chamber of commerce reports.

9. Many colleges attempt the "fast-follow" approach to technological development with no more than a two-year lag behind the most current innovations in the field. This requires ongoing needs assessments and an active, qualified advisory committee.

   Recommendation: Challenge each technical advisory committee to prepare two-year and four-year plans for program changes necessitated by new technology. Base strategic institutional planning on the technical advisory committee plans.

10. A national advisory committee with members from leading national high-technology organizations is often needed to provide information on trends in the industry and to keep the program near the "cutting edge" of technology. A good example of this is a national advisory committee, composed of representatives from leading microelectronics industries around the country, which was organized by Tri-County Technical Institute (Pendleton, SC) to serve their Microelectronics Resource Center.

    Recommendation: Contact one of the existing national advisory committees, or organize one of your own.

11. It can take up to a year of released time for a faculty member to coordinate initial program planning and development activities. When the Robotics Center was established at Piedmont Technical College (SC), $32,000 was provided for inservice and development expenses. A full year of released time for one of the Center's instructors was provided by these funds. He and another instructor participated in training sessions and work experience programs in several robotics plants. These experiences, plus other industrial visits, helped them select equipment and develop curricula.

    Recommendation: Invest the cost of released time for faculty members to prepare for new programs. It will be worth it to have a quality program from the very start.

12. In developing a new program, visits to companies that utilize the new technology provide much needed information, as do visits to any existing college programs. This system was very effectively used in establishing the high-technology Resource Centers at six South Carolina technical colleges.

    Recommendation: Use a faculty inservice day to visit industry or other colleges. Ask for a tour and a program.

Financing and Equipping

1. The availability of funds to support program development and provide equipment affects the speed and quality of programmatic responses to technological changes. Typical sources of funds are the state, foundation grants, private industry, or the college. Milwaukee Area Technical College developed its computer graphics program with funds from the National Science Foundation. The Precision Optics Program at North Lake College, Dallas County Community College District, was initiated by Texas Instruments Corporation and developed within three months—a short time compared to the usual one-year period for new program development. This was possible because Texas Instruments supplied the students, an instructor, and the equipment.

Recommendation: Invest in the staffing required for a full-fledged college development office to prepare proposals for grants and requests for other financial support.

2. Advisory committee members can be instrumental in helping the college secure funding, equipment, and facilities for new programs and courses. Most colleges reviewed reported that advisory committee members were helpful in this way.

   Recommendation: Don't hesitate to ask industry representatives on your advisory committees for corporate gifts from their employers. When gifts are received, thank-you letters should be sent by the college president, and the gifts should be well publicized (unless the donors object).

3. Up-to-date equipment and processes used in training are required for desired outcomes. Franklin Institute in Boston has solved this problem in its Medical Electronics Technology program through its cooperative relationship with Tufts-New England Medical Center (TNEMC). The students in this program are trained at TNEMC on the latest equipment, using up-to-date procedures. Students work closely with hospital staff, who direct them in the repair, calibration, and application of medical devices. Students also experience the use of medical equipment on live subjects by observing and helping to conduct animal experiments at the research facilities of the hospitals.

   Recommendation: Try cooperative education or summer internship to enable students to be involved with up-to-date equipment that your college can't afford. Phase out programs with outdated equipment rather than continue offering poor programs because you can't afford state-of-the-art facilities.

4. Many of the colleges reviewed continually seek ways to develop or expand training programs at industry sites in order to obtain access to expensive or exclusive equipment and facilities for students in high-technology training programs.

   Recommendation: Begin by offering an in-plant course for industry employees only. Typically, employees soon want to have additional classes held on campus. Use the opportunity to request access to the plant for nonemployee students to obtain familiarity with new equipment.

5. Many colleges reviewed sought the assistance of the state department of economic development (or industrial training), the state or local chambers of commerce, and industrial or business associations to gain access to or borrow equipment and materials from manufacturers and users.

   Recommendation: Approach similar organizations in your own state and make your needs known. Publicize any gift or loan you are given.

6. An economically feasible way for a college to start up an expensive high-technology program is to collaborate with an agency or industry that requests the college to do specific training for them, and is willing to finance it. After the company's critical need is met, the program can be opened up to the public. This is what occurred when Texas Instruments requested the precision optics program from North Lake College (Dallas County Community College District). Texas Instruments provided the equipment, instructor, and the students, and helped in curriculum development. Similar collaboration is possible with government agencies.

   Recommendation: Read the Federal Register and similar government publications to stay abreast of the training needs of the U.S. Department of Defense. Defense training needs may soon be met through collaboration with community colleges and technical institutes.

Staff Development and Recruitment

1. There is a scarcity of experienced instructors in new technology areas. A collaborative solution to the problem is for companies to provide inservice training, conducted by their own experienced staff, to college instructors. Cincinnati Milacron has provided instruction in robotics to faculty at Piedmont Technical College. Digital Equipment Corporation also has sent experts to upgrade faculty in minicomputer technology at its cooperating colleges, such as at Franklin Institute in Boston.

   Recommendation: Send to all your industry trainers annual letters of appointment as (unpaid) Adjunct Professors at your college, and print their names in your catalog.

2. Some private companies assist schools in the transfer of technology by providing personnel to teach on campus on a part-time basis. Most of the colleges reviewed felt that these persons frequently need help in the pedagogic aspects of lesson plans, use of instructional media, evaluation of students, and psychology of learning.

   Recommendation: Provide a short inservice education course for part-time instructors. Good materials for such a course are found in the performance-based teacher education modules developed at the National Center for Research in Vocational Education.

3. Advisory committees are very helpful in finding and recruiting qualified instructors for new technologies and/or in upgrading present instructors.

   Recommendation: Challenge each technical advisory committee to develop and offer a program or workshop to update instructors, i.e., have the advisors teach the teachers. Also place advisory committee persons on search committees when recruiting new instructors.

4. In advanced technology subject areas, a high quality professional instructional staff is essential for success, both in the educational institution and in the related industry.

   Recommendation: Design your faculty salary scale to include exceptions for high demand faculty. Then pay what it takes to get them. Do the same for part-time faculty employed in industry. They may not be willing to teach for the going rate of pay.

5. Some industries can help update college instructors by providing "hands-on" practical experiences with new equipment and technology at the work site. This may be done during instructors' released time or during summer breaks. Cincinnati Milacron, Digital Equipment Corporation, and the Allen-Bradley Company have furnished instructors at their cooperating colleges with these experiences.

   Recommendation: Inaugurate a summer "Faculty Return-to-Industry Program." It will contribute greatly to updating instructors' knowledge and skills, as well as course content. Industries often help finance such programs.

6. As technologies become more complex, it becomes increasingly important for instructors to have frequent exposure to new developments. Faculty members are brought up to date in unfamiliar technology areas or kept aware of changes in their present technology areas when industries or colleges provide funds for instructors to attend workshops, conferences, and equipment shows. At Milwaukee Area Technical College, Allen-Bradley Company covered faculty travel expenses to conferences for these purposes.

Recommendation: If you are tempted to abandon faculty attendance at workshops, conferences, or equipment shows due to lack of funds, apply for a small grant from a local foundation for faculty development travel expenses. As another alternative, consider asking faculty to absorb their own expenses. It can be tax-deductible for them.

7. Many postsecondary institutions seek to establish personnel exchange systems with producers and users of high-technology systems in order to provide inservice opportunities for faculty and to infuse state-of-the-art knowledge and practices into courses and programs.

   Recommendation: Make a plan to update faculty systematically. A good beginning with one company can spark such exchanges with other companies.

Curricula and Delivery Systems

1. In order to develop the curriculum for a new high-tech program area, selected faculty members can be given released time. This time would be used to advance their skills and knowledge in the technological area, as well as to structure the curriculum and develop instructional materials. This will require the college to find funding for a substitute instructor. Piedmont Technical College in South Carolina used this approach in its Robotics Resource Center. At Oregon's Portland Community College, a faculty member was released from regular teaching duty for a year and a half to work with advisory committee members in developing a Records Management program.

   Recommendation: Release a faculty member from 50 percent of the normal teaching load in order to free that time for developing curricular materials. Keep costs down by having administrators teach the released courses during the day, without supplemental contracts. In this way, released time does not cost hard cash, and it provides administrators with needed student contact.

2. Often a new technological development affects the content of a number of programs, and the same new core courses can add this dimension to all of these programs. Specific applications courses can be added to serve special needs. This was done at Milwaukee Area Technical College in eleven occupational program areas that require computer graphics skills.

   Recommendation: Do not identify high technology only with new degree programs. For example, introducing computer literacy into almost any occupational program will contribute to its state-of-the-art status.

3. The programs developed can be one-year or two-year degree or diploma curricula, or can be individual courses to upgrade skills of present workers in related fields. These can be offered in the day, evening, or summer, or can be workshop courses to meet user hours and needs. Colleges that have offered high-technology courses in these varied ways include Piedmont Technical College, Milwaukee Area Technical College, and Portland Community College.

   Recommendation: Study the class schedules of other colleges to get ideas on creative instructional delivery modes and scheduling.

4. Although advisory committees play an important role in helping colleges develop new curricula or revise existing curricula to respond to the changes in technology, it is difficult to maintain high levels of attendance by industry advisors. This was true of all the colleges studied in the Technology Adaptation Project.

   Recommendation: Try breakfast meetings of advisory committees if attendance has sagged.

5. In meeting the needs of high-technology industries, a frequent response of a college is to revise some existing courses and add a number of new ones. Portland Community College did this for its Word Processing and Records Management programs. Franklin Institute in Boston took this approach with both its Medical Technology Program and with its Minicomputer Technology Program.

   Recommendation: Simplify the process of internal approval of new courses and course revisions in order to be able to respond quickly to industry needs.

6. An important component of high-technology courses is a plan for "hands-on" learning experiences for students at work sites. These experiences may be cooperative education or internship programs. This approach is used successfully in the Medical Electronics Technology Program at Franklin Institute in Boston, in cooperation with Tufts-New England Medical Center. Portland Community College in Oregon has very effective cooperative programs with businesses for their Word Processing and Records Management programs.

   Recommendation: In order to understand how cooperative education or internship programs work, attend a workshop or conference on cooperative education, or read books on the topic, or visit a college with such a program in operation.

7. Successful programs have active, involved advisory committees. They participate in planning and developing high-technology programs by—
   - identifying emerging or changing occupations and determining the competencies and standards required;
   - validating and/or upgrading present courses and developing new ones when needed;
   - determining whether to create a new program or provide supplemental courses to existing programs;
   - helping the college gain any needed approvals to offer a new program by identifying current and future job demand;
   - helping the college secure educational work experience (cooperative/internship) for students and/or teachers.

   Recommendation: Provide a concise handbook on how to be an effective advisory committee member. Publish advisors' names in your college catalog. Don't ever kill their initiative or use them as mere rubber stamps to approve your own agenda.

8. In order to provide new high-technology programs, some of the strategies that have been used include: (a) establishing specialized technical education centers (such as has been done in South Carolina); (b) developing a series of modules that can serve a variety of learning objectives; and (c) applying the new technological development to a number of established occupational programs (as has been done with computer graphics at Milwaukee Area Technical College). Another strategy has been to equip mobile classrooms and labs as has been done at the Robotics Center at Piedmont Technical College. The mobile truck-van from Piedmont contains several small robots and a broad range of instructional resources and demonstration devices. It travels to other technical colleges in South Carolina to provide both instructor inservice training and student training sessions.

   Recommendation: Consider equipping your own vehicle and taking it to industry sites for instruction, as well as to high schools, malls, county fairs, and so forth, for demonstration and recruitment purposes.

9. Colleges should seek to adapt state-of-the-art courses developed by industry or the military when available. The National Center for Research in Vocational Education maintains a library of military curriculum materials available for use in sixteen broad vocational-technical education areas, and provides information on how to secure such materials.

   Recommendation: Call the National Center's Program Information Office, toll-free (800) 848-4815, and inquire about military curriculum materials.

10. If equipment or training stations are not available, instruction can be provided through simulations. Staff members in the Laser-Optics Technology program at Cincinnati Technical College have effectively developed simulations to teach certain target effects and control functions. This was necessary because of the unavailability of appropriate cooperative training stations and the lack of more powerful laser equipment.

    Recommendation: Keep abreast of microcomputer software that simulates certain effects and functions. Use simulation when equipment is not available. Although the use of simulation is not as effective a learning process as the use of real equipment, it is more effective than lectures only.

One Final Recommendation

Be careful when using the words "high technology" internally at your college. Anything new tends to threaten people, and the use of catch-phrases or jargon to describe it only increases the anxiety. Whatever people fear, they usually oppose. You will probably obtain more internal college cooperation if you ignore the words "high technology" and work to keep programs and program offerings up to date and relevant to job needs.

APPENDIX A
THE TECHNOLOGY ADAPTATION PROJECT

Much of the material in this paper is based on information gathered in the Technology Adaptation Project, conducted by the National Center for Research in Vocational Education and sponsored by the U.S. Department of Education. The purpose of the Technology Adaptation Project was to identify and investigate successful practices of postsecondary institutions assisting businesses and industries in adopting or adapting advanced technology innovations.

The first step in the research process was to identify five high-technology areas as the focuses for the study of successful approaches. Based on reviews of many sources, five general types of advanced technologies were selected. These were—

- advanced manufacturing technologies (including robotics);
- computer applications technologies;
- microelectronics technologies;
- business office technologies;
- health technologies.

A list of candidate colleges linked with businesses and industries in the five technology areas was compiled from the following sources:

- Recommendations from the American Association of Community and Junior Colleges (AACJC)
- Recommendations of National Postsecondary Alliance members and postsecondary staff at the National Center
- Telephone calls to corporate headquarters of companies using or manufacturing high-technology equipment or processes
- Reviews of research reports and popular literature

From this list, colleges were selected and then contacted for permission to make site visits and to obtain help in arranging visits to collaborative businesses and industries. The list of colleges and businesses/industries where site visits were conducted is presented in Appendix B.

From the visits to colleges and companies, and from follow-up telephone calls, the project staff prepared case study reports on the successful practices in ten colleges (five of which were studied in conjunction with their collaborating businesses/industries).

The reports, *Preparing for High Technology, Book 1* (Strategies for Change) and *Preparing for High Technology, Book 2* (Programs That Work), will be available in May, 1982. For purchasing information, write or call:

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Telex: 8104821894

APPENDIX B

FIELD SITE VISITS
TECHNOLOGY ADAPTATION PROJECT

Educational Sites

Massachusetts:	Bunker Hill Community College
	Franklin Institute of Boston
	Minute-Man Vocational-Technical School
	Wentworth Institute
North Carolina:	Catawba Valley Technical College
	Central Carolina Technical College
	Durham Technical College
	North Carolina State Department of Community and Technical Colleges
	North Carolina State University Industrial Engineering Department
Oregon:	Lane Community College
	Linn-Benton Community College
	Portland Community College
South Carolina:	Columbia State Department of Technical Education
	Greenville Technical College
	Midlands Technical College
	Piedmont Technical College
	Tri-County Technical College
Texas:	Brazoport College
	College of the Mainland
	North Lake College
Utah:	Uintah Basin Area Vocational School
	Utah Technical College—Provo
	Utah Technical College—Salt Lake
Wisconsin:	Milwaukee Area Technical College

Business and Industry Sites:

Massachusetts:	Digital Equipment Corporation, Boston
	Tufts-New England Medical Center, Boston
Ohio	Cincinnati Milacron

Oregon:	Emmanuel Hospital Employee Benefits Insurance Company Port of Portland
Texas:	Dow Chemical, Freeport Monsanto, Texas City Texas Instruments, Dallas
Utah:	Interstate Brick Company, Salt Lake City National Semiconductor, West Jordan Signetics, Provo Utah Power and Light, Salt Lake City
Wisconsin:	A. O. Smith, Milwaukee Allen-Bradley, Milwaukee

Research Organization Sites:

Georgia:	Georgia Technical Institute
North Carolina:	Microelectronics Center of North Carolina

APPENDIX C

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Wahpeton, ND

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Charleston, SC

Triton College
River Grove, IL

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